REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims:

Claims 1, 4-9, and 21 have been amended. Claims 28-34 are added as new claims. Thus, claims 1, 4-11, 18, 21, 24, and 27-33 are presented for examination.

Claim Objections:

Claims 5-8 were objected to for reasons of informalities and typographical errors. Claims 5-8 have been amended accordingly.

35 U.S.C. §112 Rejections:

Claims 5, 7, and 21 are rejected under 35 U.S.C. §112, second paragraph.

For claims 5, 7, and 21, in view of the amendments, the above-referenced rejections are respectfully traversed.

Claims 5, 7, and 21 have been amended to remove references to "ceramic powder" or "the powder". Hence, all elements in claims 5, 7, and 21 have sufficient antecedent basis, and therefore claims 5, 7, and 21 are allowable under 35 U.S.C. 112, second paragraph.

Prior Art Rejections:

Claims 1, 5-6, 8, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Flükiger et al. (WO 96/28853). Claims 1, 4, 5, 7, 9-11, and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Dubots et al. (U.S. Patent No. 4,954,479). Claims 1 and 5 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 01-95409. Claims 4, 11, 18, 24, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flükiger in view of JP63239741. Claims 4 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 01-95409 in view of JP63239741.

With respect to claims 1, 4-11, 18, 21, 24, and 27-33, in view of the amendments, the above-referenced rejections are respectfully traversed.

As amended, claim 1 discloses a method of producing an oxide superconducting wire comprising the steps forming a ceramic layer on the surface of a superconductor precursor rod to produce a ceramic-coated rod, inserting a plurality of ceramic-coated rods into a metal pipe to form a multifilament billet, and subjecting said multifilament billet to plastic deformation to form a multifilament wire, wherein the ceramic layer of each rod is in contact with the ceramic layer of at least one other rod. As illustrated in figure 1, the resulting superconducting wire 29 comprises a plurality of superconductor filaments 27 contained in a metal pipe 24. The ceramic layers 22 of the superconductor filaments are in contact with one another.

Flükiger does not disclose the step of coating the surface of the superconductor precursor rods with a ceramic layer, or that the ceramic layer of each rod is in contact with that of another rod, as recited by claim 1. Flükiger describes forming a metal oxide layer on the metal sheath of each superconducting core. Flükiger states that "[e]ach elongated, superconducting core ... is encased by an electrically conducting sheath which is encased by a sheath having at least one metal oxide ...". (Flükiger, page 10, lines 13-15.) Hence, Flükiger lacks the step of forming a ceramic layer directly on the surface of the superconductor precursor rods, because each superconducting core is encased in a metal sheath. Page 18 of Flükiger describes a method of forming the metal oxide layer by oxidizing the "starting casings", which is the metal conducting casing directly covering each superconducting cores. The individual metal (conducting) sheath is an important element of Flükiger, as it is directed to electrically bridge random breaks in the cores. (See Flükiger, page 12, lines 3-5.) In contrast, by coating the superconductor rod directly with a ceramic layer, claim 1 of the present invention aims at reducing the AC loss of the superconducting wire and increasing its critical current density (see paragraph [0024] of the specification), while also reducing the manufacturing cost by reducing the use of silver (see paragraph [0026] of the specification).

Further more, each superconducting filament in Flükiger is covered by a outer metal sheath. (Flükiger, page 14, lines 2-3). As illustrated in Figs. 1-3 of Flükiger, the oxide layer (element 5) around each superconducting core (element 3) is covered by an outer conducting

sheath (element 6). Fig. 3 of Flükiger clearly indicates that in a multifilament wire, the outer metal sheath (element 6) separates the insulating layer (element 5) of one superconducting core (element 3) from that of another. In contrast, claim 1 teaches that the ceramic layer of each rod is in contact with that of at least another rod. The use of the ceramic layer without a metal sheath provides advantages of improving perpendicular resistance and reducing AC loss (paragraph [0039] of the current specification), while improving the permeability of air released during the processing (paragraph [0025] of the current specification).

Because Flükiger neither discloses nor suggests the coating of the surface of the superconductor precursor rod with a ceramic layer or the contact between ceramic layers of different rods, claim 1 is allowable over Flükiger.

Claim 1 recites that "the ceramic layer of each ceramic-coated rod in contact with the ceramic layer of at least one other ceramic-coated rod" and that the multifilament billet is subject to plastic deformation and heating. Dubots does not teach or suggest these elements. Dubots disclose the formation of a single-filament superconducting wire with a filament (sole figure, element 1) coated with several insulating layers (sole figure, elements 2 and 4), an aluminum cladding layer (sole figure, element 3), all inside a metal pipe (sole figure element 5). In Dubots, a multifilament strand is formed by stacking several single-filament wires together. (Dubots, col. 2, lines 49-61.) Therefore, in Dubots, while there is an oxide layer directly formed on the superconducting core (sole figure, elements 2 and 1), the oxide layer of one superconducting strand is separated from that of another superconducting strand in a multifilament strand by the metal layers (elements 3 and 5) covering each individual filament (element 1).

Furthermore, Dubots describes plastic deformation and heating of individual wires (Dubots, col. 2, lines 46-52), then goes on to state that "[in] order to obtain a multifilament strand, a plurality of monofilament strands obtained as described above are stacked together." (Dubots, col. 2, lines 59-61). Hence it is clear that in Dubots, the plastic deformation and heating occur on individual wires before the step of stacking into a multifilament strand. In contrast, in the method disclosed in claim 1, the plastic deformation and heat treatment occurs on the multifilament billet, after multiple ceramic-coated rods are inserted into a metal pipe.

Because Dubots neither teaches nor suggests the ceramic layer of each rod in contact with that of another rod, or the plastic deformation and heating treatment of the multifilament billet, claim 1 of the present invention is patentable over Dubots.

JP 01-95409 does not anticipate claim 1 for substantially the same reasons as stated above in reference to Dubots. JP 01-95409 teaches that each individual superconducting core (Fig. 5, element 2) is covered by an outer metal heath (Fig. 5, element 4). Hence, even if the single wires are bundled together to form a multi-filament wire, the metal sheaths (Fig. 5, element 4) prevents the oxide layer (Fig. 5, element 3) of one superconducting core from contacting another. Furthermore, JP 01-95409 does not teach the steps of plastic deformation and heating after the formation of a multifilament billet.

Since none of the cited references teach or suggest the elements of claim 1, it is thus submitted that claim 1 is allowable over the cited references. In particular, none of the references teach that the ceramic layer of one rod is in contact with the ceramic layer of at least one other rod. Hence, claim 1 is not obvious even if the cited references were combined, if there was such a motivation to do so. Since claims 5-11 are dependent claims of claim 1, they are allowable for at least the same reason as those stated above for claim 1.

Similarly, independent claim 4 is also amended to teach that "the ceramic layer of each ceramic-coated rod [is] in contact with the ceramic layer of at least one other ceramic-coated rod". Furthermore, claim 4 teaches that the ceramic layer is formed on the surface of the coated rod by extrusion.

Dubots does not anticipate claim 4 for substantially the same reason as stated above for claim 1. In Dubots, conducting layers (sole figure, elements 3 and 5) separate the insulating layer (element 2) surrounding one superconductor strand from that of another, when multiple strands are stacked together to form a multifilament wire. Also, Dubots teaches plastic deformation and heating for individual wires, before stacking a plurality of individual wires to form a multifilament wire. In contrast, claim 4 recites that the ceramic layer of one rod is in contact of that of at least one other rod, and that the plastic deformation and heat treatment steps are performed after the formation of the multifilament billet.

Claim 4 can also be distinguished from Flükiger because of the element that "the ceramic layer of each ceramic-coated rod [is] in contact with the ceramic layer of at least one other ceramic-coated rod". As discussed above in reference to claim 1, each filament of the multifilament wire in Flükiger has an individual metal sheath (Figs. 1-3, element 6) separating element 5 of one filament from that of another. This deficiency is not cured by a combination with JP63239741.

Similarly, claim 4 can also be distinguished from a combination of JP 01-95409 and JP63239741 because neither teaches the element that "the ceramic layer of each ceramic-coated rod [is] in contact with the ceramic layer of at least one other ceramic-coated rod". (See the discussion above in reference to claim 1.)

Furthermore, the step of forming the ceramic layer on the surface of the coated road by extrusion claimed in claim 4 cannot be arrived through combining Flükiger (or JP01-054-9) with JP 63239741. Both Flükiger and JP01-95409 are directed at a method of manufacturing a superconducting wire through a "powder-in-tube" method, where a powder mixture is filled into a conducting tube serving as a sheath and later turned into superconductor through heating. (See Flükiger, page 13, lines 1-9). On the other hand, JP63239741 is directed at the extrusion of a slurry compound composed of a superconductor and a non-superconductor to make a composite line. (See JP63239741, abstract.) The cited references are inherently incompatible with one another. For example, one cannot extrude powder (e.g., particulate mixture disclosed in Flükiger, page 13, lines 1-9) using a slurry extrusion method as used in JP 63239741 to form a line. The extrusion taught by JP63239741 is for a slurry compound of superconducting oxide and non-superconducting oxide. (See JP63239741, abstract.) In contrast, in claim 4, the ceramic layer is extruded onto the surface of the coated-rod, wherein the coated-rod is formed in a previous step from a superconductor precursor. As an example, the specification teaches the extrusion of a ceramic powder onto a already-existing rod by compression. (See paragraph [0093] of the current specification.) The step of extruding a ceramic layer onto a rod provides the advantage of producing a high density ceramic layer with no gaps. (See paragraph [0033] of the current specification). Furthermore, in claim 4, the precursor is not converted into a superconductor until a subsequent step of heat treatment. Hence, the extrusion method taught by

JP63239741 where a superconducting and a non-superconducting components are extruded together in a slurry cannot be combined with other references to teach the step of extruding a ceramic layer onto a rod comprising a superconductor precursor to form a ceramic-coated rod.

Since none of the cited references teach that "the ceramic layer of each ceramic-coated rod [is] in contact with the ceramic layer of at least one other ceramic-coated rod", and the cited reference cannot be combined to form the extrusion process of claim 4, independent claim 4 is patentable over the prior arts. Since claims 18, 21, 24, and 27 are dependent claims of claim 4, they are allowable for at least the same reasons as stated above for independent claim 4.

Claim 11 (dependent claim of claim 1) also teaches that the ceramic layer is formed by an extrusion process. Therefore, claim 11 is distinguishable over a combination of Flükiger (or JP01-95409) with JP 63239741 for the same reasons as stated above for claim 4 with respect to the extrusion process. Therefore, claim 11 is allowable over the cited references for this reason in addition to reasons stated above for claim 1.

New claims 28-30 are added to further distinguish the cited references. Claims 28 and 29 state that "the ceramic-coated rods [are] in a spaced relationship with respect to each other and with no metal between the spaced ceramic-coated rods". Flükiger, Dubots, and JP 01-95409 all teach the formation of at least one a metal layer between the spaced superconducting rods.

New claims 31-34 are added to further protect the invention. New claims 31-34 are directed at an oxide superconducting wire and are similar to the method of producing an oxide superconducting wire recited in claims 1, 4, and 28-30.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to

Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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